REMARKS

This Preliminary Amendment is in response, in part, to the Office Action dated September 11, 2002 pertaining to co-pending application Serial No. 09/626,537. In the Office Action, the Examiner identified that the present application and the '537 application have potentially conflicting claims. Accordingly, some claims has been cancelled in the present application, while other claims have been added from the '537. Furthermore, many of the previously existing claims herein have been amended to more clearly recite features of the claimed invention.

Claims 88-92, 97-99, and 101 are amended as shown above. In part, Claims 88-92, 97-99, and 101 have been renumbered to correct an inadvertent error. Claims 93-96 and 100 are cancelled. New claims 103-129 have been added. Claims 89-93, 98-100, and 102-129 are now pending in the application. Applicants respectfully assert that none of the pending claims in the present application conflict with claims in the '537 application. For the reasons set forth below, the Applicants respectfully request reconsideration and allowance of all pending claims.

Argument in Support of Allowance of Amended Independent Claims 89, 98, and 102

Applicants respectfully assert that each of amended independent claims 89, 98, 102 is patentable over the cited art. In particular, each of these claims have been amended to make clear that elements for producing a first and second plurality of transmission peaks in a tunable filter are employed to enable tuning of channels, wherein a channel is tuned by aligning a transmission peak from among the first plurality of transmission peaks with a transmission peak from among the second plurality of transmission peaks.

With respect to claim 89, prior to the present amendment, the Examiner rejected a claim 59 having similar subject matter under 35 U.S.C. § 102(e) as being anticipated by Sesko et al., U.S. Patent No. 6,205,159 (hereinafter *Sesko* or the '159 patent), stating that *Sesko* teaches in Figure 2A a tunable filter apparatus comprising a grid

generator (4) positioned in an optical path and configured to generate a first set of transmission peaks corresponding to channels of a selected wavelength grid, **see col. 11, lines 46-49**; and a channel selector (5) positioned in the optical path and configured to generate a second set of transmission peaks, **see col. 12, lines 46-48**. Claim 88, as amended herein, now recites:

89. (Amended once) A tunable filter apparatus, comprising:

(c) a grid generator to be positioned in an optical path and configured to generate a first plurality of transmission peaks corresponding to channels within a selected wavelength range; and

(d) a channel selector to be positioned in said optical path and configured to generate *a second plurality of transmission peaks within said wavelength range, said channel selector including means for tuning the second plurality of transmission peaks relative to the first set of transmission peaks such that a single pair of respective transmission peaks from among the first and second plurality of transmission peaks may be aligned.* (Emphasis added)

It is clear that this claim is not anticipated by *Sesko*. In particular, *Sesko* does not employ a channel selector that generates a second plurality of transmission peaks within the wavelength range of the selected wavelength grid. Rather, *Sesko* employs a liquid crystal Fabry-Perot interferometer 5 that generates a single transmission peak within the wavelength range of the selected wavelength grid, as shown in the transmission graph B of Figure 3, reproduced below.

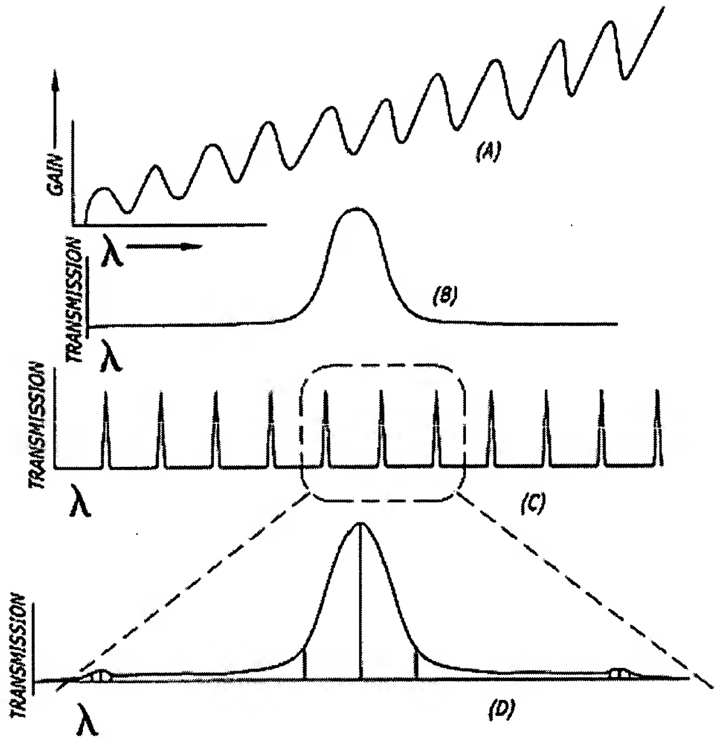

FIG. 3

As stated in the paragraph beginning at col. 15, line 15,

FIG. 3 clarifies the relationship between various axial modes that may exist and the filtering properties of the interferometers [4 and 5] placed within the external cavity. Gain curve A of FIG. 3 shows part of the gain bandwidth of the antireflection coated laser diode. The modulation of this gain curve is due to the presence of residual reflectivity on the front facet. Below this curve, the transmission of the liquid crystal Fabry-Perot interferometer [5] is shown. In this curve B, a finesse of 200 and *a free spectral range of 100 nm* is assumed, which are close to the actual values. *If the bandwidth of the laser diode is so broad that light is transmitted through more than one free spectral range of the liquid crystal interferometer an optional bandpass filter is used to narrow the bandwidth of the laser. The tuning range of the liquid crystal Fabry-Perot interferometer [5] will be less than the free spectral range of the interferometer.* ***This is true so that there will not be two transmission peaks under the gain curve of the laser diode***. The double pass transmission of the static etalon is illustrated below this by the comb peaks. *These peaks in curve C are separated by 100 GHz which corresponds to the channel spacings for the WDM communications wavelengths* and has a finesse of 100. Thus the static etalon will have a

> bandpass of 1 GHz which will filter out the external cavity longitudinal modes. The combined transmission of the liquid crystal Fabry-Perot interferometer and the static etalon is shown as curve D of FIG. 3 on an expanded scale. On this we also show the external cavity modes. (Emphasis added)

Col. 12, lines 46-48 further states, "In FIG. 2A, the liquid crystal etalon 5 serves as the course tuning element, *discriminating between the peaks defined by the solid etalon 4*." (Emphasis added)

It is clear that the Fabry-Perot interferometer 5 does not generate a plurality of transmission peaks within the wavelength range of the selected wavelength grid, as recited in amended claim 89. Rather, the Fabry-Perot interferometer 5 generates a single transmission peak, as shown in gain curve B. Furthermore, from the text description, "the tuning range of the liquid crystal Fabry-Perot interferometer 5 will be less than the free spectral range of the interferometer." As is well-known in the art, the "free spectral range" corresponds to the distance between transmission peaks generated by an optical filter element, such as the liquid crystal Fabry-Perot interferometer 5 and static etalon 4. In order to tune across all channels of the wavelength grid (i.e., tune across the wavelength range), the liquid crystal Fabry-Perot interferometer 5 is supplied with a voltage input (see e.g., FIGs. 2A and 2B) to cause the single transmission peak to be shifted relative to the comb peaks of gain curve C. However, this tuning range (i.e., across the wavelength range) is less than the distance between the transmission peaks that might be produced by the liquid crystal Fabry-Perot interferometer (its free spectral range). Thus, the gain curve of the interferometer within the selected wavelength range can contain one and only one transmission peak. Furthermore, *if the bandwidth of the laser diode is so broad that light is transmitted through more than one free spectral range of the liquid crystal interferometer* (meaning that the interferometer would produce another transmission peak that would appear off of the graph to the left or right of gain curve B) *an optional bandpass filter **is used to***

narrow the bandwidth of the laser (to limit the bandwidth such that only one transmission peak is produced by the interferometer).

In contrast, the claimed invention of claim 89 employs a tunable element (the channel selector) that produces a (second) plurality of transmission peaks that can be tuned relative to the (first plurality of) transmission peaks produced by the grid generator. In one embodiment corresponding to new claim 104, tuning is accomplished by shifting a second plurality of transmission peaks having a second constant free range spectrum relative to the first plurality of transmission peaks having a first constant free range spectrum. In another embodiment corresponding to new claim 103, tuning is accomplished by adjusting the free spectrum range of the second plurality of transmission peaks such that individual transmission peaks are moved different distances (wavelengths) relative to a fixed set of transmission peaks produced by the grid generator. In either case, a channel is selected by aligning one of the transmission peaks in the first plurality of transmission peaks generated by the grid generator with one of the transmission peaks in the second plurality of transmission peaks generated by the channel selector. As is well-known in the art, the transmittance of a series of optical filters is a product of the gain curves of those filters. Thus, a peak corresponding to the combined transmittance of the grid generator and the channel selector will be generated where the transmission peaks of the two filters are aligned, as shown in FIGs. 5A-C of the present application, while other portions of the spectrum will be attenuated. This peak corresponds to a selected channel. Furthermore, the selected channel will correspond to one of the channels defined by the grid generator. The combined transmittance peak, and thus the selected channel can be changed by shifting the second plurality of transmission peaks produced by the channel selector relative to the first plurality of transmission peaks produced by the grid generator such that a transmission peak from among the first plurality of transmission peaks

corresponding to a new grid generator channel is aligned with one of the transmission peaks in the second plurality of transmission peaks.

In summary, it is clear that the claimed invention of amended claim 89 is not anticipated by *Sesko*. Accordingly, amended claim 89 is in condition for allowance. Similar claim language is recited in amended claim 98, which is a method claim analogous to the apparatus claim of claim 89. Accordingly, claim 98 is also in condition for allowance for at least the same reasons as claim 89.

With respect to amended independent claim 102, this claim now recites:

102. (Amended once) A tunable filter apparatus for an optical beam, comprising:

(c) grid means for generating a first plurality of transmission peaks corresponding to channels in a selected wavelength range, said grid means to be positioned in said optical beam; and

(d) channel selector means for generating a second plurality of transmission peaks, said channel selector means to be positioned in said optical path and *to tune the optical beam by aligning one of the second plurality of transmission peaks with one of the first plurality of transmission peaks.* (Emphasis added)

Again, this claim recites the generation of respective pluralities of transmission peaks that are aligned to select a channel in a manner similar to that employed in the invention of claim 89. Clearly, *Sesko* does not disclose, teach, or suggest all of the claim elements and limitations of amended claim 89. Accordingly, amended claim 89 is in condition for allowance.

<u>Argument in Support of Allowance of New Independent Claims 117 and 127</u>

Applicants have added new claim 117 and 127 by the present amendment. Claim 117 recites:

117. A method for tuning an optical beam, comprising:

filtering the optical beam to define a first plurality of pass bands substantially aligned with corresponding channels in a selected wavelength grid having a wavelength range;

filtering the optical beam *to define a second plurality of pass bands within the selected wavelength grid*; and

tuning the second plurality of pass bands with respect to the first plurality of pass bands to select channels at which to tune the optical beam, wherein the optical beam is tuned to a channel when one of the pass bands in the second plurality of pass bands is aligned with a pass band in the first plurality of pass bands corresponding to a selected channel. (Emphasis Added)

This claim recites the operation of defining a second plurality of pass bands and then tuning the second plurality of pass bands to tune to a selected channel. The pass bands are analogous to the transmission peaks discussed above. A second plurality of pass bands are clearly not disclosed, taught, or suggested by *Sesko*. Accordingly, new claim 117 is in condition for allowance.

With respect to new claim 127, this claim pertains to a communication apparatus corresponding to FIG. 8 that employs the tunable filter of the invention in an optical path between to circulators. Applicants respectfully assert this claim is patentable over the cited art for at least the same reasons as claim 88 argued above.

<u>Argument in Support of Allowance of Claims Specifying Difference of Free Spectral Ranges</u>

In the prior Final Office Action of December 4, 2001, the Examiner rejected claims 62, 64, 71,and 73, under 35 U.S.C. 103(a) as being unpatentable over *Sesko.*

To establish a *prima facie* case of obviousness, there must first be some suggestion or motivation to modify a reference or to combine references, and second be a reasonable expectation of success. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in

the prior art and not based on applicant's disclosure. M.P.E.P. § 706.02(j) from *In Re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Where claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under § 103 requires, inter alia, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed device; and (2) whether the prior art would also have revealed that in so making, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the Applicants' disclosure. *Amgen v. Chugai Pharmaceutical*, 927 F.2d 1200, 18 USPQ2d 1016 (Fed. Cir. 1991), *Fritsch v. Lin*, 21 USPQ2d 1731 (Bd. Pat. App. & Int'f 1991). An invention is non-obvious if the references fail not only to expressly disclose the claimed invention as a whole, but also to suggest to one of ordinary skill in the art modifications needed to meet all the claim limitations. *Litton Industrial Products, Inc. v. Solid State Systems Corp.*, 755 F.2d 158, 164, 225 USPQ 34, 38 (Fed. Cir. 1985).

The examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. M.P.E.P. § 70602(j) from *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985). Obviousness cannot be established by combining references without also providing evidence of the motivating force which would impel one skilled in the art to <u>do what the patent applicant has done</u>. M.P.E.P. § 2144 from *Ex parte Levengood*, 28 USPQ2d 1300, 1302 (Bd. Pat. App. & Inter. 1993) (emphasis added by M.P.E.P.).

New Claims 106 and 122 recite similar subject matter to previously rejected claims 62, 64, 71,and 73. For example, claim 106 recites:

The apparatus of claim 105, wherein the channel selector defines a second tunable optical path length determinative of a second tunable free spectral range which

differs from the first free spectral range of the grid generator by an amount substantially equal to the quotient of the first free spectral range divided by one of the number of channels of the selected wavelength grid or the quotient of the first free spectral range divided by a subset of the number of channels of the selected wavelength grid.

In rejecting claims 62, 64, 71, and 73, the Examiner asserted that Sesko teaches all of the stated limitations of each of the claims except the difference between the first and second spectral ranges. The Examiner then cited *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955), stating, "It has been held, '[W]here the general conditions of the claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.'" The principle is not applicable here.

Claim 106 specifically states, in its first option, for example, that the difference in the free spectral ranges of the grid generator and the channel selector is substantially equal to the quotient of the first free spectral range divided by the number of channels of the selected wavelength grid. This relationship allows vernier tuning of the filter. For example, as recited on page 16, line 28 – page 17, line 3 of the 'present application, in an exemplary embodiment employing 128 channels at 50 GHz spacing the FSR of the grid generator would be 50 GHz, and the difference between the FSRs for the grid generator and the channel selector (tuner) would be +/-0.39 GHz. Thus, the difference between the FSRs is very small, and is selected such that shifting the transmission peaks of the channel selector only one FSR of the grid generator enables all of the channels (128 in this case) to be tuned.

50 GHz spacing corresponds to a wavelength grid have a .4 nm (nanometer) wavelength spacing, and the difference between the FSRs in terms of wavelength is approximately .4 nm/128 = 1/330 nm for the 128 channel example. In the example discussed above disclosed by *Kesko*, the grid wavelength spacing is .2 nm (*These peaks in curve C are separated by 100 GHz which corresponds to the channel spacings*

for the WDM communications wavelengths and has a finesse of 100). Thus, to generally meet the quotient requirement of claim 65, the channel spacing for a 128 channel implementation would be approximately 1/660 nm. At the very least, the FSRs of the grid generator and the liquid crystal Fabry-Perot interferometer should be approximately the same to support vernier tuning (this is how verniers scales work). In stark contrast, the '159 specification states that the free spectral range of the liquid crystal Fabry-Perot interferometer is assumed to be 100 nm (In this curve B, a finesse of 200 and *a free spectral range of 100 nm* is assumed, which are close to the actual values – discussed above.) Thus the difference between the FSR of the grid generator and the FSR of the liquid crystal Fabry-Perot interferometer is approximately 99.8 nm. This isn't even within four orders of magnitude of the difference employed by the claimed invention, and most certainly doesn't meet the claim requirements of claim 106, or the principles of *In re Aller*.

As discussed above, the term "free spectral range" refers to a distance or spacing between transmission peaks produced by optical filters such as etalons. More specifically, the term "range" in "free spectral range" actually refers to the range (in wavelength) of a portion of the light spectrum (i.e., a single value), and is not a "range" of values, is indicated by the Examiner. MPEP §2144.05 relates to the obviousness of "ranges" and optimization of a range within prior art conditions or through routine experimentation. The case *In re Aller* noted by the Examiner involved recited process conditions that differed slightly in temperature and chemical concentration from prior art teachings.

It is clear that *Sesko* does not disclose, teach, or suggest all of the claim elements and limitations of claim 106 or 122. Accordingly, claims 106 and 122 are in condition for allowance.

Use of the term "Substantially" in a Claim

In a prior Office Action of April 27, 2001, the Examiner rejected previously-filed claims under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. More specifically, the Examiner indicated that the term "substantially" is a broad term and does not constitute a limitation in any patentable sense. Applicant respectfully disagrees with this statement. As provided by MPEP 2173.05(b), "The fact that claim language, including terms of degree, may not be precise, does not automatically render the claim indefinite under 35 U.S.C. § 112, second paragraph . . . Acceptability of the claim language depends on whether one of ordinary skill in the art would understand what is claimed, in light of the specification. As further provided in MPEP 2173.05(b)D, the term "substantially" may be used in a claim when it defines a definite limitation. In particular,

> The court held that the limitation "which produces substantially equal E and H plane illumination patterns" was definite because one of ordinary skill in the art would know what [is] meant by "substantially equal." Andrew Corp v. Gabriel Electronics, 847 F.2d 819, 6 USPQ2d 2010 (Fed. Cir. 1988). (MPEP 2173.05(b)D)

Both the specification and claims 106 and 122 use the term "substantially equal" in defining the mathematical relationship between the free spectral ranges under embodiments of the invention, such as exemplified by equations IA, IB, II, III, and IV. (the $\approx$symbol in mathematical equations means approximately or substantially equal). Accordingly, new claims 106 and 122 are not indefinite.

Conclusion

Overall, none of the references singly or in any motivated combination disclose, teach, or suggest what is recited in the independent claims. Thus, given the above amendments and accompanying remarks, independent claims 89, 98, 102, 117, and 127 are now in condition for allowance. The dependent claims that depend directly or

indirectly on these independent claims are likewise allowable based on at least the same reasons and based on the recitations contained in each dependent claim.

If the undersigned attorney has overlooked a teaching in any of the cited references that is relevant to the allowability of the claims, the Examiner is requested to specifically point out where such teaching may be found. Further, if there are any informalities or questions that can be addressed via telephone, the Examiner is encouraged to contact the undersigned attorney at (206) 292-8600.

Charge Deposit Account

Please charge our Deposit Account No. 02-2666 for any additional fee(s) that may be due in this matter, and please credit the same deposit account for any overpayment.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN

Date: October 4, 2002

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MARKED-UP VERSION OF THE AMENDED CLAIMS

[88] 89. (Amended once) A tunable filter apparatus, comprising:

(a) a grid generator to be positioned in an optical path and configured to generate a first plurality of transmission peaks corresponding to channels within a selected wavelength range; and

(b) a channel selector to be positioned in said optical path and configured to generate a second plurality of transmission peaks within said wavelength range, said channel selector including means for tuning the second plurality of transmission peaks relative to the first set of transmission peaks such that a single pair of respective transmission peaks from among the first and second plurality of transmission peaks may be aligned.

[89] 90. (Amended once) The apparatus of claim [88] 89, wherein said grid generator has a first free spectral range and said channel selector has a second free spectral range[, said second free spectral range] different from said first free spectral range, and wherein tuning is effectuated by shifting the second plurality of transmission peaks relative to the first plurality of transmission peaks to align one of the transmission peaks from the second plurality of transmission peaks with a transmission peak from the first plurality of transmission peaks having a frequency or wavelength corresponding to a selected channel.

[90] 91. (Amended once) The apparatus of claim [89] 88, further comprising a gain medium positioned to emit an optical beam along said optical path and receive optical feedback from said grid generator and said channel selector, said grid generator and said channel selector operable to select a wavelength of said optical feedback to said gain medium.

[91] <u>92</u>. (Amended once) The apparatus of claim [90] <u>91</u>, wherein at least one of said grid generator and said channel selector is configured to operate in transmission.

[92] <u>93</u>. (Amended once) The apparatus of claim [90] <u>91</u>, wherein at least one of said grid generator and said channel selector is configured to operate in reflection.

[97] <u>98</u>. (Amended once) A method for tuning an optical beam, comprising:

(a) generating a first plurality of transmission peaks corresponding to channels within a selected wavelength range;

(b) generating a second plurality of transmission peaks within said selected wavelength range; and

(c) [selecting] <u>tuning</u> said second plurality of transmission peaks with respect to said first plurality of transmission peaks to tune said optical beam <u>to align one of the second plurality of transmission peaks with one of the first plurality of transmission peaks</u>.

[98] <u>99</u>. (Amended once) The method of claim [97] <u>98</u>, wherein:

(a) [said] generating said first plurality of transmission peaks comprises positioning a grid generator [ins] <u>having a first free spectral range</u> <u>in</u> said optical beam[, said grid generator having a first free spectral range]; and

(b) [said] generating said second plurality of transmission peaks comprises positioning a channel selector <u>having a second free spectral range</u> in said optical beam[, said channel selector having a second free spectral range].

[99] <u>100</u>. (Amended once) The method of claim [98] <u>99,</u> wherein [said] tuning said second plurality of transmission peaks with respect to said first plurality of transmission

peaks comprises adjusting said second free spectral range with respect to said first spectral range.

[101] 102. (Amended once) A tunable filter apparatus for an optical beam, comprising:

(a) grid means for generating a first plurality of transmission peaks corresponding to channels in a selected wavelength range, said grid means to be positioned in said optical beam; and

(b) channel selector means for generating a second plurality of transmission peaks, said channel selector means to be positioned in said optical path and to tune the optical beam by aligning one of the second plurality of transmission peaks with one of the first plurality of transmission peaks.